

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

This Page Blank (uspto)



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶: H04L 29/06, 12/56	A1	(11) International Publication Number: WO 99/03242 (43) International Publication Date: 21 January 1999 (21.01.99)
(21) International Application Number: PCT/EP98/04076 (22) International Filing Date: 1 July 1998 (01.07.98) (30) Priority Data: 9714686.4 11 July 1997 (11.07.97) GB (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON [SE/SE]; S-126 25 Stockholm (SE). (72) Inventor: ERIKSSON, Anders; Skebokvarnsvägen 43, S-124 33 Bandhagen (SE). (74) Agent: O'CONNELL, David, Christopher; Haseltine Lake & Co., Imperial House, 15-19 Kingsway, London WC2B 6UD (GB).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: RESOURCE RESERVATION		
(57) Abstract <p>A method is provided for achieving admission control to a public connectionless packet network. This provides a method of access control which allows service differentiation in a form which permits a user to receive a quality of service guarantee which is better than a "best effort" service. Each transmission by a user across the network includes a message sent to the user from the network. The message includes information about the priority level of the transmission, based on the user's contract with the network provider, and can subsequently be extracted by the network to determine how to handle the transmission, and to determine the resources available for future transmission requests.</p>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon		Republic of Korea	PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

RESOURCE RESERVATIONTECHNICAL FIELD OF THE INVENTION

This invention relates to the field of resource reservation, and in particular to a method of
5 controlling access to a communications network, and to a network using such a method.

DESCRIPTION OF RELATED ART

The Internet is a communications network which is becoming widely available. The Internet provides a
10 "best effort" bearer service. That is, the user receives the best service available at the time he requests it, but no commitments are given to the user in terms of available bandwidth, transit delay, or packet loss. The Internet is particularly useful in
15 data communications applications, but is of limited use for telecommunications applications which require guaranteed bandwidth availability, and specify maximum values for the transit delay and loss of data. The Internet cannot usually guarantee the required quality
20 of service.

One conventional way of achieving resource reservation, to be able to provide a required quality of service commitment, is to use connection states to store information in the network nodes about bandwidth,
25 buffer parameters, connection identity and status. However, an advantage of the Internet is that it is a connectionless network, which therefore cannot use this technique without sacrificing the simplicity of the Internet.

30 One conventional way of achieving bearer service differentiation, in a connectionless network, is to use a set of priority bits in the packet header. However, in a public connectionless network, it is still necessary to control how many connections use the
35 highest available priority. If every connection uses the highest available priority, the network can still

-2-

in effect only offer a best effort service to the users.

A problem remains, therefore, as to how to control admission to the network.

5 TECHNICAL FIELD OF THE INVENTION

The present invention seeks to solve the problem of achieving admission control and resource reservation in a connectionless network.

10 A further object of the invention is to provide a method of access control which, in preferred embodiments, allows service differentiation in a form which permits a user to receive a quality of service guarantee which is better than a "best effort" service.

15 According to the invention, each transmission by a user across the network includes a message sent to the user from the network. The message includes information about the priority level of the transmission, based on the user's contract with the network provider, and can subsequently be extracted by
20 the network to determine how to handle the transmission.

25 Thus, rather than rely on the network being able to detect the status of the connection, the relevant information is transmitted by the user with the data transmission, and can be extracted by the network as required.

30 For a better understanding of the present invention, and to show how it may be brought into effect, reference will now be made, by way of example, to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a schematic representation of a network in accordance with the invention.

35 Figure 2 illustrates the flow of signalling messages in accordance with the invention.

Figure 3 is a flow chart indicating the steps

taken in a method in accordance with the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 represents a network in accordance with the invention. In Figure 1, a user at terminal A intends to send a message, in the form of data packets, to terminal B across the Internet. The Internet includes a large number of nodes, of which only a small number are shown in Figure 1. These are designated real-time routers RR, while the node to which the terminal A is connected is designated the access router AR.

Although the invention is described herein with reference to the Internet, it is applicable to any connectionless packet network, whether public or private.

In accordance with preferred embodiments of the invention, the sender has a traffic contract with its network provider, under which a particular quality of service is guaranteed. This allows the network provider to offer service differentiation to users. Thus, users who are prepared to pay higher charges are able to guarantee access to higher bandwidths, or higher priority traffic handling.

The flow of signalling messages during a data transmission will now be described with reference to Figure 2, while the steps taken in the access router AR will be described with reference to the flow chart of Figure 3.

When the sender wishes to initiate a data transmission, a user resource reservation request REQ-U is sent from the terminal A, and received at the access router AR in step 1 of the method. The resource reservation request specifies the required bandwidth for the transmission, the required traffic class, the source address and the destination address. These parameters are thus set for the duration of the

-4-

transmission at this stage.

5 In step 2 of the method, it is determined at the
access router AR whether the resource reservation
request passes the admission control. This admission
control is performed in a generally conventional way,
in that the required bandwidth specified in the
resource reservation request is checked against the
bandwidth available to that user, and in the system
generally. If the resource reservation request does
10 not pass the admission control, the request is denied.

As described in more detail below, the information
needed for admission control is not stored in the
network on a per connection basis, but can be extracted
by the network as required from messages associated
15 with every transmission which gains access to the
network. Thus, these messages must contain all
information which is necessary to allow the network
nodes to perform admission control and policing of the
transmission as required.

20 If the resource reservation request passes the
admission control, the method passes to step 3. Here,
the access router AR sends a network resource
reservation request REQ-N across the Internet to the
terminal B. Each node in the transmission path can
25 perform resource reservation and admission control. If
the required bandwidth is available across the network,
an acknowledgement is sent from the terminal B to the
access router AR, and received in step 4 of the method.

As described above, it is assumed that the network
30 is able to support resource reservation from end to
end. However, it will be appreciated that the
invention is equally applicable when resource
reservation is only available over a specific network
domain, covering only a part of the end to end path.
35 In such a case, the reservation protocol is terminated
by the routers at the edges of that network domain.

Following receipt by the access router AR of the acknowledgement message, required information about the state of the connection is passed, in accordance with the invention, from the network to the user A in step 5 of the method. Specifically, information about the resources allocated to the connection, and other connection parameters (for example those specified in the traffic contract) is sent from the access router AR to the sender A in a ticket message. The information in the ticket message is preferably protected by a digital signature, to prevent its alteration by the user A.

Then, during transmission of the data across the network the ticket message is inserted into the data packet flow by the sender. The ticket message may be sent with every packet of the data flow, or may be inserted periodically. As a further alternative, if the network polices data flows on a sample basis, the ticket message may be included only when requested by the network. Any ticket message is received at the access router in step 6 of the method illustrated in Figure 3. The access router, and other nodes in the transmission path, can then use the ticket message for policing the packet flows, in step 7 of the method. Thus, if a packet flow seeks to use a particular priority level or bandwidth, without including a ticket message which authorises such use, the flow can be policed.

The ticket message is then transmitted across the network with the data packet flow. Thus, the ticket message has a function which is similar in some ways to the priority bits which can be added to a packet header before transmission across a connectionless network. However, the ticket message used in accordance with the invention is determined by the network itself, so that it becomes possible to ensure that users receive a

service which is in accordance with their quality of service guarantees, and ensures that users cannot reserve high priority resources which go beyond those guaranteed.

5 In one embodiment, the user must still set priority bits in a conventional way, but the ticket message, determined by the network and transmitted by the user with the data flow, states which priority levels may validly be set by the user for a particular
10 data flow.

 As indicated in step 8 of the method illustrated in Figure 3, the network can use the ticket message at any time to extract information about the connection. For example, the ticket message may contain information
15 about the allocated bandwidth, the priority level, the quality of service parameters, and the time of expiry thereof, amongst other things. Thus, this information does not need to be stored within the network on a per connection basis, but rather the network can remain
20 connectionless. However, the network can obtain the information which it requires about all connections, in order to be able to calculate the total amount of resources which have been allocated in every priority level on every link in the network. This allows the
25 network admission control function to determine whether a new resource reservation request can be accepted, or must be rejected.

 As an alternative to using the ticket messages in this way, the estimation of the resources already
30 reserved can be achieved using a conventional method such as measuring the aggregate data flow. The ticket message may then only be used to request new reservations and to support policing.

 Further possible uses of the ticket messages
35 transmitted in accordance with the invention are to support charging, for example by logging the tickets

-7-

for a data flow, or for network management purposes, for example using the periodic transmission and acknowledgement of the ticket message as an indication that a data channel is operational.

5 A further advantage of the invention is that an operator can choose to run his network in a connectionless manner, as described herein, or in a connection oriented mode, using the information in the request and ticket messages to set up a connection
10 state for the data flow. A single message, passing through several operator domains, can pass through networks operating in both modes. It may be advantageous to use a connection oriented mode in an access router to support charging, while the rest of
15 the network operates in a connectionless manner.

 There is thus described a system which allows bearer service differentiation in a connectionless network.

CLAIMS

1. A method of reserving network resources for a transmission from a first network user, the method comprising:

5 receiving a resource reservation request from the first network user to initiate a reservation;
confirming that the required resource is available;

10 sending from the network to the first network user a message containing all necessary connection information; and

allowing access to the network for a transmission from the first network user, the transmission including the message containing connection information.

15 2. A method as claimed in claim 1, wherein the message containing connection information cannot be altered by the first network user.

20 3. A method as claimed in claim 2, wherein the message containing connection information is protected by a digital signature.

4. A method as claimed in claim 1, wherein the message containing connection information is used to police access to the network.

25 5. A method as claimed in claim 1, wherein the message containing connection information includes information about a bandwidth allocated to the transmission.

30 6. A method as claimed in claim 1, wherein the message containing connection information includes information about a priority level allocated to the transmission.

35 7. A method as claimed in claim 1, wherein the message containing connection information includes information about a quality of service guarantee to the first network user.

8. A method as claimed in claim 1, wherein the

message containing connection information includes information about a time of expiry thereof.

5 9. A method as claimed in claim 1, wherein the message containing connection information includes information about a source address of the transmission.

10 10. A method as claimed in claim 1, wherein the message containing connection information includes information about a destination address of the transmission.

11. A node for a communications network, comprising:

means for receiving an access request from a user;

means for determining whether resources are available for a received access request;

15 means for transmitting to the user a message containing all necessary connection information, if resources are available; and

means for restricting access to the network to allow access only to transmissions including an appropriate message containing connection information.

20 12. A node for a communications network, as claimed in claim 11, comprising:

means for extracting data from messages containing connection information associated with respective transmissions; and

25 means for using said data for determining whether resources are available for the received access request.

30 13. A method of achieving admission control in a network, the method comprising:

receiving a resource reservation request from a user to initiate a reservation;

35 sending to the user a ticket message containing all necessary connection information;

requiring a subsequent transmission from the user to return the ticket message; and

-10-

applying admission control on the basis of the
content of the ticket message.

1 / 2

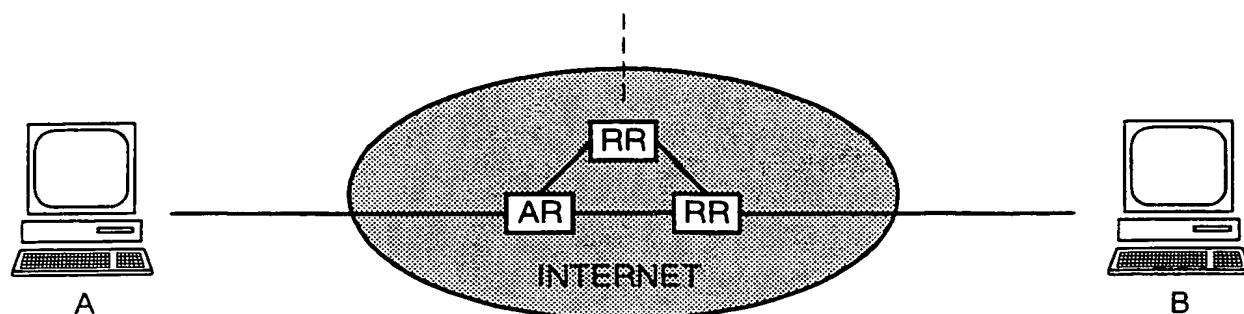


FIG.1

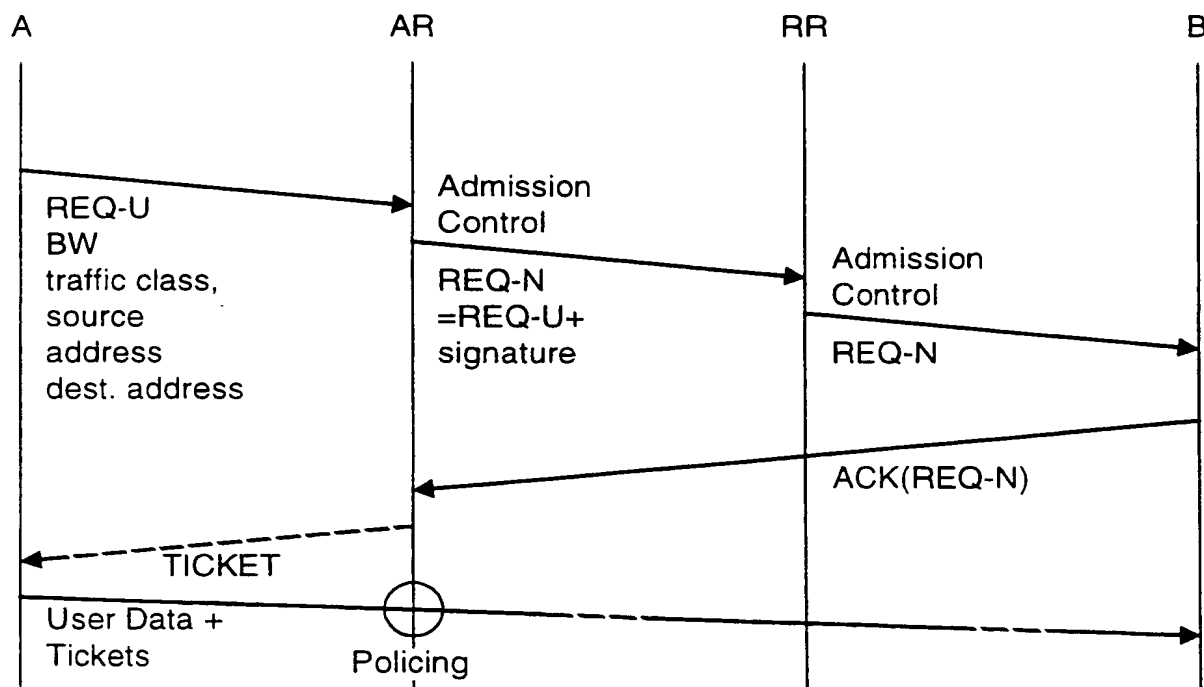


FIG.2

2 / 2

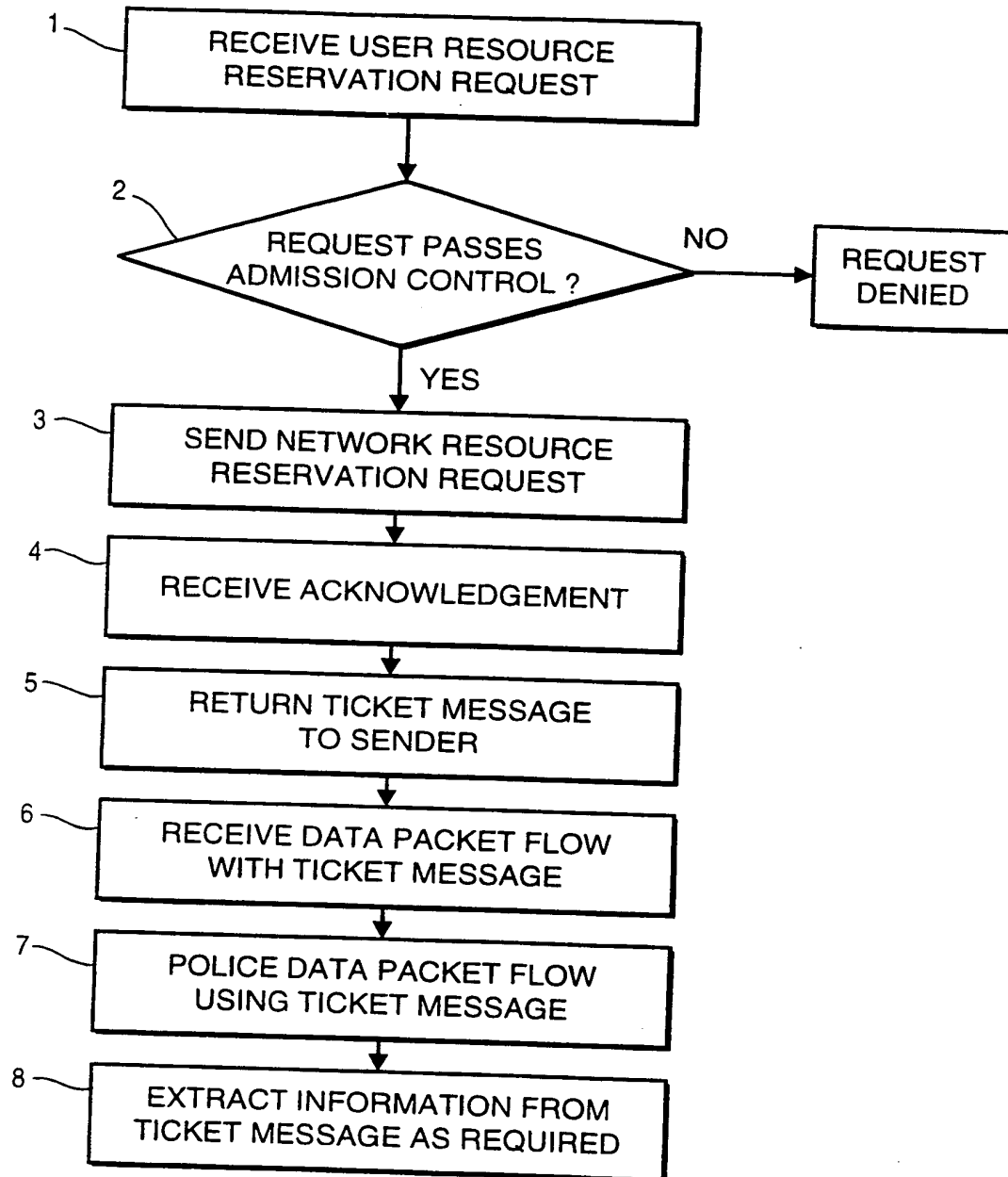


FIG.3

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 98/04076

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L29/06 H04L12/56

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 603 099 A (IBM) 22 June 1994 see page 2, column 1, line 1 - page 4, column 6, line 31; figure 1 ----	1-13
A	WHITE P P: "RSVP AND INTEGRATED SERVICES IN THE INTERNET: A TUTORIAL" IEEE COMMUNICATIONS MAGAZINE, vol. 35, no. 5, May 1997, pages 100-106, XP000657115 see the whole document ----	1-13
A	EP 0 609 654 A (NIPPON ELECTRIC CO) 10 August 1994 see page 2, line 40 - page 4, line 25; figures 1,3 -----	1-13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

23 October 1998

Date of mailing of the international search report

30/10/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Karavassilis, N

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 98/04076

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0603099	A	22-06-1994	US 5367517 A	22-11-1994
			JP 2527913 B	28-08-1996
			JP 7015473 A	17-01-1995
EP 0609654	A	10-08-1994	JP 2087336 C	02-09-1996
			JP 6205040 A	22-07-1994
			JP 7107991 B	15-11-1995
			JP 6338918 A	06-12-1994
			JP 6338903 A	06-12-1994
			CA 2112756 A	07-07-1994
			US 5636212 A	03-06-1997